



City of Cleveland
Justin M. Bibb, Mayor

Department of Finance
Division of Purchases & Supplies
601 Lakeside Avenue, Room 128
Cleveland, Ohio 44114-1080
216/664-2620 • Fax: 216/664-2177
www.cleveland-oh.gov

August 8, 2025

ADDENDUM 1

BID TITLE: File No. 99-25 Transformers and Accessories 2025

BID DUE: Thursday, August 28, 2025 at 12 o'clock noon (Eastern Time)

Attention Bidders:

We have been requested to issue the addendum for the following:

Please ensure that a copy of this addendum is included and returned with the bid specifications furnished to you by this office, as it will have the same force and effect as if it were part of the specifications originally issued.

1. Notify potential bidders that the bid opening date for this bid has been extended.
2. Provide to potential bidders revised Bid – Schedule of Items pages and a revised Section D -Detailed Specifications both of which are to replace those pages received in the original bid package.
3. Address those questions received from potential bidders.

If you have any questions regarding the attached, please contact Jules Gilliam at jgilliam@clevelandohio.gov. Thank you for your prompt attention and assistance in this matter. Also, please ensure that copy of this addendum is included and returned with the bid specifications furnished to you by this office, as it will have the same force and effect as if it were part of the specifications originally issued.

Signature of Potential Bidder & Name of Company

Today's Date

Thank you,
Donia Patterson, Assistant Administrator
Purchases & Supplies
CC:

ADDENDUM NO. 1

BID — SCHEDULE OF ITEMS

City of Cleveland Division of Purchases and Supplies 128 City Hall Cleveland, Ohio 44114				BIDDER MUST COMPLETE AND SIGN BELOW	
TITLE OF BID Transformers and Accessories 2025 / File no. 99-25				NAME OF FIRM	
ORDINANCE NO. 1630-92, Section 129.26				STREET ADDRESS	
PASSED: September 21, 1992		SIGNED September 25, 1992		CITY STATE ZIPCODE	
DEPARTMENT Public Utilities		DIVISION Cleveland Public Power		AUTHORIZED SIGNATURE	
CITY RECORD ADVERTISEMENT DATES: July 16, 2025 & July 23, 2025		X STANDARD CONTRACT BID REQUIREMENT CONTRACT BID		DATE:	
BUYER Jcilliam@clevelandohio.gov Purchasing@clevelandohio.gov Phone (216) 664-2621 / Fax: (216) 664-2275				BID OPENING: Thursday, 28-Aug-25 12 O'CLOCK OFFICIAL TIME	
DESCRIPTION		QTY.	UOM	UNIT PRICE	EXTENSION
GROUP A - 2400 V TRANSFORMER SINGLE PHASE STANDARD POLE TYPE					
A.1	2.4 kV, 37.5 kVA, 1 PH 120/240 V (CPP PART# 612000)	36	EA	\$	\$
A.2	2.4 kV, 50 kVA, 1 PH 120/240 V (CPP PART# 612100)	36	EA	\$	\$
A.3	2.4 kV, 75 kVA, 1 PH 120/240 V (CPP PART# 612200)	12	EA	\$	\$
A.4	2.4 kV, 100 kVA, 1 PH 120/240 V (CPP PART# 612800)	6	EA	\$	\$
TOTAL GROUP A				\$	
GROUP B - 12000 V TRANSFORMER SINGLE PHASE STANDARD POLE TYPE					
B.1	12 kV, 50 kVA, 1 PH 120/240 V (CPP PART# 612750)	20	EA	\$	\$
B.2	12 kV, 75 kVA, 1 PH 120/240 V (CPP PART# 612550)	20	EA	\$	\$
B.3	12 kV, 500 kVA, 1 PH 2400 V (CPP PART# 606600)	18	EA	\$	\$
TOTAL GROUP B				\$	
GROUP C - 12000 V TRANSFORMER SINGLE PHASE PADMOUNT TYPE DF/LF					
C.1	12 kV, 167 kVA, 1 PH, 120/240 V (CPP PART# 610885)	1	EA	\$	\$
TOTAL GROUP C				\$	
ALL OF THIS BOUND INFORMATION MUST BE KEPT INTACT AND, TOGETHER WITH ANY ADDENDA ISSUED, MUST BE RETURNED WITH THE BID. OTHERWISE, THE BID MAY BE CONSIDERED INFORMAL.				DELIVERY	(Days)
				PAYMENT DISCOUNT %	
				% Days	
FOR PURCHASING USE ONLY					

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BID SCHEDULE OF ITEMS					BIDDER MUST COMPLETE AND SIGN BELOW	
TITLE OF BID					NAME OF FIRM:	
Transformers and Accessories 2025 / File no. 99-25						
AUTHORIZED SIGNATURE:					DATE:	
DESCRIPTION	QTY.	UOM	UNIT PRICE	EXTENSION		
GROUP D - 2400 V TRANSFORMER THREE PHASE PADMOUNT TYPE DF/LF						
D.1	2.4 kV, 75 kVA, 3 PH, 208/120 (CPP PART# 610905)	2	EA	\$	\$	
D.2	2.4 kV, 150 kVA, 3 PH, 208/120 (CPP PART# 610901)	1	EA	\$	\$	
TOTAL GROUP D				\$		
GROUP E - 12000 V TRANSFORMER THREE PHASE PADMOUNT TYPE DF/LF						
E.1	12 kV, 75 kVA, 3 PH, 480/277 V (CPP PART# 610912)	2	EA	\$	\$	
E.2	12 kV, 112.5 kVA, 3 PH, 208Y/120 V (CPP PART# 610890)	1	EA	\$	\$	
E.3	12 kV, 150 kVA, 3 PH, 208Y/120 V (CPP PART# 610908)	1	EA	\$	\$	
E.4	12 kV, 300 kVA, 3 PH, 208Y/120 V (CPP PART# 610875)	2	EA	\$	\$	
E.5	12 kV, 500 kVA, 3 PH, 208Y/120 V (CPP PART# 610927)	7	EA	\$	\$	
E.6	12 kV, 500 kVA, 3 PH, 480Y/277 V (CPP PART# 610926)	1	EA	\$	\$	
E.7	12 kV, 750 kVA, 3 PH, 208Y/120 V (CPP PART# 610924)	2	EA	\$	\$	
E.8	12 kV, 1000 kVA, 3 PH, 208Y/120 V (CPP PART# 606660)	3	EA	\$	\$	
E.9	12 kV, 1000 kVA, 3 PH, 480Y/277 V (CPP PART# 606665)	3	EA	\$	\$	
E.10	12 kV, 1500 kVA, 3 PH, 480Y/277 V (CPP PART# 606675)	3	EA	\$	\$	
E.11	12 kV, 2000 kVA, 3 PH, 480Y/277 V (CPP PART# 606670)	4	EA	\$	\$	
E.12	12 kV, 2500 kVA, 3 PH, 480Y/277 V (CPP PART# 610877)	2	EA	\$	\$	
TOTAL GROUP E				\$		
GROUP F - 13800Y V TRANSFORMER THREE PHASE PADMOUNT TYPE DF/LF						
F.1	13.8 kV, 75 kVA, 3 PH, 208Y/120 V (CPP PART# 609050)	3	EA	\$	\$	
F.2	13.8 kV, 150 kVA, 3 PH, 208Y/120 V (CPP PART# 609085)	1	EA	\$	\$	
F.3	13.8 kV, 300 kVA, 3 PH, 208Y/120 V (CPP PART# 609120)	3	EA	\$	\$	
F.4	13.8 kV, 500 kVA, 3 PH, 208Y/120 V (CPP PART# 609135)	2	EA	\$	\$	
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AUTHORIZED SIGNATURE:					DATE:	
DESCRIPTION	QTY.	UOM	UNIT PRICE	EXTENSION		
GROUP F - 13800Y V TRANSFORMER THREE PHASE PADMOUNT TYPE DF/LF (CONT'D)						
F.5	13.8 kV, 750 kVA, 3 PH, 208Y/120 V (CPP PART#609150)	3	EA	\$	\$	
F.6	13.8 kV, 750 kVA, 3 PH, 480Y/277 V (CPP PART#609160)	3	EA	\$	\$	
F.7	13.8 kV, 1000 kVA, 3 PH, 480Y/277 V (CPP PART#609170)	2	EA	\$	\$	
F.8	13.8 kV, 1500 kVA, 3 PH, 480Y/277 V (CPP PART#609180)	3	EA	\$	\$	
F.9	13.8 kV, 2000 kVA, 3 PH, 480Y/277 V (CPP PART#607300)	3	EA	\$	\$	
TOTAL GROUP F				\$		
GROUP G - 12000 V TRANSFORMER THREE PHASE (SUBMERSIBLE)						
G.1	12 KV, 1500 KVA, 3 PH, 480Y/277V, SUBMERSIBLE (CPP PART #606201)	2	EA	\$	\$	
G.2	12 KV, 2500 KVA, 3 PH, 480Y/277V, SUBMERSIBLE (CPP PART #615973)	3	EA	\$	\$	
TOTAL GROUP G				\$		
GROUP H - 2400 V VOLTAGE REGULATOR						
H.1	2-50 kVA - 2.4 kV Voltage Regulators, Multi-Phase control and interconnection cables, as specified (CPP PART# 461050)	4	EA	\$	\$	
TOTAL GROUP H				\$		
GROUP I - SUBSTATION TRANSFORMERS						
I.1	5000/6250 kVA 12000 - 2400/4160Y/2400 V. Substation Transformer, as specified (CPP PART # 615916)	6	EA	\$	\$	
TOTAL GROUP I				\$		
TOTAL ALL GROUPS A THROUGH I				\$		
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RESPONSES TO QUESTIONS SUBMITTED BY POTENTIAL BIDDERS

Q. Could you please confirm if there are any restrictions with the country of origin of the transformers?

A. CPP Engineering has not put any restrictions on the "country of origin" in the Transformer bid technical specifications.

Q. Will the City accept quotes for individual items, and not entire groups? Will the City consider awarding individual items and not entire groups? I had the impression from the pre-bid call that only full groups would be considered, but the bid package says the City reserves the right to award individual items.

A. Please refer to Section C – Supplemental General Conditions, Item C.6. Method of Award, which outlines the City rights regarding any award under this contract.

Q. When will the City be placing orders for the items in this RFQ?

A. Once the award contract or contracts has been finalized.

Q. When does the City expect the items to be delivered?

A. Delivery will be based on the delivery days provided by the awarded bidders.

Q. Our team is requesting a .doc version of the bid package; can this be provided?

A. No, the City does not provide editable versions of our bid packages.

Q. Can you provide a PDF or DOC version of the General Conditions section of the bid package? We would like this for review purposes where we need to copy sections into our own documentation. Alternatively, is there a copy of them available on the City web page?

A. Yes, the bid package is available on the City website to download PDF documents.

Q. Can you provide an extension.

A. Yes, Bid will be extended until August 28, 2025.

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RESPONSES TO QUESTIONS SUBMITTED BY POTENTIAL BIDDERS

Q. What is the significance of the yellowed sections on page 5 and 6 of the bidders checklist?

A. As a reminder to bidders to include the requested documentation with your bid response and to inform them of City requirements for some of our bid projects.

Q. Will the City of Cleveland accept/consider Progress payments?

A. No.

Q. Will the city of Cleveland consider a controller like SEL or Beckwith? In the specification, an Eaton controller is requested. At this time, Eaton is offering a lead-time of over 50 weeks. This would significantly increase our delivery time of approx. 25-27 weeks.

A. An SEL or Beckwith control would be considered. Or equal substitutes of the Eaton control are allowed.

Q. Item D.5.2 b) Our fast switch supports currents up to 668A, which would be sufficient to meet the requested regulator. However, our switch does not have a vacuum interrupter. Is it acceptable to use our fast switch that supports the currents up to 668A.

A. It is acceptable to use the fast switch with sufficient capacity for the size of the regulator. The requirement for the vacuum interrupter is removed.

Q. Item D.5.2 c) Our catalog for our position sensor which works with our electronic controllers is attached. Is this acceptable.

A. The position sensor is acceptable.

Q. Item D.5.2 e) The City of Cleveland requests an "internal differential potential transformer (IDPT)," which is a differential PT for use with the CL7 control, used as a safety feature by Eaton.

A. The internal differential potential transformer or its equivalent is required by the specification.

Q. Item D.5.2 i) Our wiring is coded by labels. Will the city of Cleveland accept this standard?

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A. Any type of clearly coded wiring is acceptable.

Q. Item D.5.3 c) Will the city of Cleveland accept surge arrester by Hubbell, attached in this e-mail.

A. The proposed Hubbell SDV surge arresters are acceptable.

Q. Item D.5.3 f) The customer requests a function called SOFT-ADD-AMP, which can be activated locally or via SCADA, and is adjusted by additional currents. This function is specific to the CL-7 control.

A. The requirement for the SOFT-ADD-Amp feature has been removed. The locally controllable ADD-AMP feature or its equivalent remains a requirement of the specification.

Q. Item D.5.4) Will the city of Cleveland accept a single-phase controller from SEL or Beckwith? The specification requests the CL-7 control, or equivalent, part number #CL72E60000LB33, which is a multiphase control.

A. The city would accept two single-phase controllers in lieu of the multiphase control specified. One single-phase control for each of the voltage regulators.

Q. It is for the group A pole mounted units.

Is the primary voltage is only 12,000V or 12,000/20,780Y with BIL value.

A. The transformer needs to be a two bushing unit capable of line-to-line connection on a 12 kV delta system. Either the 12,000V or 12,000/20,780Y rating is acceptable.

**SPECIFICATION/DESCRIPTIONS OF PRODUCTS AND/ OR SERVICES
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A. The internal differential potential transformer or its equivalent is required by the specification.

Q. Item D.5.2 i) Our wiring is coded by labels. Will the city of Cleveland accept this standard?

A. Any type of clearly coded wiring is acceptable.

Q. Item D.5.3 c) Will the city of Cleveland accept surge arrester by Hubbell, attached in this e-mail.

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A. The requirement for the SOFT-ADD-Amp feature has been removed. The locally controllable ADD-AMP feature or its equivalent remains a requirement of the specification.

Q. Item D.5.4) Will the city of Cleveland accept a single-phase controller from SEL or Beckwith? The specification requests the CL-7 control, or equivalent, part number #CL72E60000LB33, which is a multiphase control.

A. The city would accept two single-phase controllers in lieu of the multiphase control specified. One single-phase control for each of the voltage regulators.

**Q. It is for the group A pole mounted units.
Is the primary voltage is only 12,000V or 12,000/20,780Y with BIL value.**

A. The transformer needs to be a two bushing unit capable of line-to-line connection on a 12 kV delta system. Either the 12,000V or 12,000/20,780Y rating is acceptable.

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SECTION D – DETAILED SPECIFICATIONS

D.1. OVERHEAD DISTRIBUTION

These transformers shall be the pole-mounted type. All ANSI standard accessories and nameplates shall be provided.

General Requirements:

- A. De-energized tap changer with external handle.
- B. Lockable tap changer handles on transformers 150 kVA and larger.
- C. Color ANSI No. 70, light gray.
- D. Shall include pressure relief device.

D.1.1. 2400 VOLT SINGLE-PHASE OVERHEAD DISTRIBUTION (Group A)

Specific requirements:

- a. 2,400 Volt transformers shall be equipped with 2 (two) 2½% taps below and 2 (two) 2½% taps above full rated voltage.
- b. Tank wall mounted high voltage bushings.
- c. CSP type transformers shall also include:
 - 1. 6 kV MOV surge arresters.
 - 2. Secondary breaker, coordinated with protective link to trip on external shorts and overloads before link blows. With an external handle to trip and reset the breaker. External provision for recalibrating the breaker for emergency overloads.
 - 3. Internal fuse link, to remove faulted transformer from primary line.
 - 4. Signal light, indicating overloading and breaker operation.

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SECTION D – DETAILED SPECIFICATIONS

5. Tank isolation gap, tank wall mounted. Secondary arrestor and protective gap for isolation of transformer from Ground for spark-over.

D.1.1. 12,000 VOLT SINGLE-PHASE OVERHEAD DISTRIBUTION (Group B)

Specific requirements:

- a. 12,000 Volt transformers shall be equipped with 4 (four) 2½% taps below full rated voltage.
- b. Cover mounted high voltage bushings.
- c. Transformers with 2,400 and 7,970-Volt secondary.
 - 1. Shall include upper filter press connection.
 - 2. Shall include combination oil drain, bottom filter press, and sampling valve.
 - 3. Auto-transformer connections are not acceptable.

D.2. SINGLE-PHASE PADMOUNT TRANSFORMERS

These transformers shall be designed and constructed in accordance with the latest revision of the following ANSI Standards C57.12.00, C57.12.25, C57.12.28, C57.12.35, C57.12.90, C57.12.91

General Requirements:

- A. Full compliance with ANSI C57.12.28 enclosure integrity requirements, with captive stainless steel penta-head door locking bolt and floating lock pocket.
- B. Primary termination, loop feed dead front. Four 200 A. universal load break bushing wells on 12kV and 2.4 kV transformers and two 200 A. universal load break bushing on wells on 13.8 kV transformers, shipped assembled with load break inserts and equipped with parking stand accessory with provisions for parking brackets.
- C. Arranged for loop feed switching with two - 2 position (ON/OFF) single-pole load break switches on 13.8 kV transformers and two – 2 position (ON/OFF) two-pole load break

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SECTION D – DETAILED SPECIFICATIONS

switches on 12 kV and 2.4 kV transformers.

- D. Single bushing designs, on unit rated 13,800GrdY/7,970 Volts primary. Two bushings' designs, on units rated 2.4 kV and 12 kV.
- E. 13,800GrdY/7,970 Volt primary winding on 13.8kV transformers for all secondary voltages. 2.4kV line-to-line connected primary windings on transformers designated 2.4kV for all secondary voltages. 12kV line-to-line connected primary windings on transformers designated 12kV for all secondary voltages.
- F. Furnished with full capacity high voltage taps, with cover mounted external operating handle. The external de-energized tap changer operating handle shall be clearly marked per ANSI C57.12.20
- G. Fusing: load break, load sensing bayonet fuse connected in series with a backup current limiting fuse capable of interrupting 50,000 A. rms. symmetrical.
- H. Secondary terminations, copper NEMA four- or six-hole spades.
- I. A fully insulated secondary neutral bushing (X₂) with a removable copper ground strap for connection to the tank shall be provided.
- J. BIL of 95 kV, 12 kV and 13.8 kV windings.
- K. BIL of 60 kV, 2.4 kV windings.
- L. BIL of 30 kV, all voltages less than 600 V.
- M. Automatic/manual pressure relief device.
- N. Oil drain/sampling valve.
- O. Color: Green

D.2.1. 12,000 V Single-Phase Padmount (Group C)

12000 Volt transformers shall be equipped with 4 (four) 2½% taps below full rated voltage.

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SECTION D – DETAILED SPECIFICATIONS

D.3. THREE-PHASE PADMOUNT TRANSFORMERS

These transformers shall be designed and constructed in accordance with the latest revision of the following ANSI Standards C57.12.00, C57.12.26, C57.12.28, C57.12.90, C57.12.91, C57.12.92.

Successful bidder shall furnish three-phase Padmount transformer dimensions and drawings for transformer pad requirements after contract award.

General Requirements for all Three-Phase Padmount Transformers:

- a. Full compliance with ANSI C57.12.28 enclosure integrity requirements, with captive stainless steel penta-head door locking bolt and floating lock pocket.
- b. Primary termination, loop feed dead front. Six 200 A. universal load break bushing wells shipped assembled with a load break inserts. With two, ON/OFF load break oil switches.
- c. Furnished with full capacity high voltage taps, with external operating handle. The external de-energized tap changer operating handle shall be clearly marked per ANSI C57.12.20
- d. Fusing: load break, load sensing bayonet fuse connected in series with a backup current limiting fuse capable of interrupting 50,000 A. rms. symmetrical.
- e. Automatic/manual pressure relief device.
- f. Oil drain/sampling valve and fill plug.
- g. Cover mounted hand hole under weather cover.
- h. Color: Green
- i. Transformers with 12 kV and 13.8 kV windings shall have a BIL of 95 kV.
- j. Transformers with 2.4 kV and 4.16 kV windings shall have a BIL of 60 kV.

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SECTION D – DETAILED SPECIFICATIONS

- k. Transformers with secondaries rated at a voltage below 600 V. shall have a BIL of 30 kV.
- l. Secondary connections shall be NEMA stud to flat 6- or 8-hole connectors. Six-hole pads shall be provided on transformers with secondary windings rated at less than 2,000 Amperes Eight-hole connectors on transformers rated greater than 2,000 Amperes.

D.3.1. 2400 V Three-Phase Padmount (Group D)

Transformers designated 2.4 kV are for use on a 2.4 kV ungrounded delta system.

- a. These transformers shall be equipped with two (2) 2 ½ % taps above and two 2 ½ % taps below full rated voltage.
- b. 2400 Volt Delta connected primary windings on all 2400 Volt three phase Padmount transformers.
- c. Transformers rated 500 kVA and below with a 240-volt Delta secondary shall have 120 volts mid-tap in one phase.

D.3.2. 12000 V Three-Phase Padmount (Group E)

- a. 12,000 Volt transformers shall be equipped with 4 (four) 2½% taps below full rated voltage.
- b. 12,000 Volt Delta primary windings on all 12000 Volt three phase Padmount transformers.
- c. Transformers rated 500 kVA and below with a 240-volt Delta secondary shall have 120 volts mid-tap in one phase.

D.3.3. 13,800 V Volt Three-Phase Padmount (Group F)

- a. 13,800 Volt transformers shall be equipped with 2 (two) 2½% taps above and 2 (two) 2½% taps below full rated voltage.

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- b. 13,800 Volt transformers with 480Y/277 Volt secondary windings shall be Delta-Wye connected and shall have a phase displacement of 30 degrees.
- c. 13,800 Volt transformers with 240 Volt Delta secondary windings shall be Delta-Delta connected and shall have a phase displacement of 0 degrees, transformers rated 500 kVA and below with a 240-volt Delta secondary shall have 120 volts mid-tap in one phase.
- d. 13,800 Volt transformers with 208Y/120 Volt secondary windings shall be Wye-Wye connected and shall have a phase displacement of 0 degrees.
- e. 13,800 Volt Delta connected primary winding on transformers with a 2,400/4,160Y/2,400 V secondary. Phase displacement for 13,800 – 2,400 Volt connection shall be 180 degrees.

D.4. THREE-PHASE SUBMERSIBLE TRANSFORMERS

These transformers shall be designed and constructed in accordance with the latest revision of the following ANSI Standards C57.12.00, C57.12.25, C57.12.28, C57.12.35, C57.12.90, C57.12.91

General Requirements:

- a. These transformers shall be submersible type suitable for operation while submerged completely in water.
- b. Primary termination, dead front, loop feed. Three cover mounted two-position ON/OFF load break oil switches for loop feed switching and fuse interlock.
- c. Furnished with full capacity high voltage taps all supplied with cover mounted external operating handle. The external de-energized tap-changer-operating handle shall be clearly marked per ANSI C57.12.20.
- d. Bushing wells are to be welded to the cover and shipped assembled with load break inserts and dead-end protective caps.
- e. Fusing: cover-mounted draw out current limiting fuses with 50,000 A. interrupting capacity, interlocked with two-position load break switch

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- f. Secondary connections shall be NEMA stud to flat 4-hole, 6-hole or 8-hole connectors.
 - 1. 4-hole pads on transformers with secondary windings rated at or less than 800 amperes.
 - 2. 6-hole or 8-hole connectors on transformers with secondary rated greater than 800 amperes.
- g. Color: Black
- h. Automatic/manual pressure relief device.
- i. Primary BIL of 95 kV
- j. Secondary BIL of 30 kV for all voltages less than 600V

D.4.1. 12,000 V Primary Three-Phase Submersible (Group G)

Specific Requirements:

Transformers shall be furnished with 4 (four) 2½% taps below full rated voltage on 12,000 V units with cover mounted external operating handle. The external de-energized tap changer operating handle shall be clearly marked per ANSI C57.12.20.

12,000 V delta primary windings on all 12000 V three-phase transformers

D.5. SINGLE-PHASE STEP VOLTAGE REGULATORS (Group H)

This specification covers two 50 kVA 2400 V. voltage regulators, a multiphase control for two regulators and all necessary interconnecting cables.

D.5.1. VOLTAGE REGULATORS

The Voltage regulators shall be the equivalent of Eaton / Cooper VR-32 regulators.

- a. This specification covers electrical, mechanical, and safety features and characteristics of outdoor, single-phase, oil-immersed, step-type voltage

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regulators. The voltage regulators must be completely self-contained and provide 10% regulation in thirty-two (32) steps of approximately 5/8% each.

- b. The regulators furnished under this specification shall be designed, manufactured, and tested in accordance with ANSI Standard C57.15, latest revision thereof. This Standard shall be a part of this specification.
- c. Regulator rating and operating voltage shall be as specified on the Bid Schedule of items.
- d. The regulator shall be furnished with dielectric fluid. The fluid shall contain less than 1 part per million PCBs (Polychlorinated Biphenyls) and this shall be so stated on the regulator nameplates.

D.5.2. INTERNAL CONSTRUCTION

- a. The regulators shall be designed such that they can be partially or completely untanked for inspection and maintenance without disconnecting any internal electrical or mechanical connections. (External connections must be disconnected.) Two military specification-style quick disconnect circular connectors shall be provided with a solid-state automatic current transformer shorting device located in a junction box located on the cover.
- b. The reactance tap-changing mechanism shall be a direct motor drive and quick break with vacuum interrupter design and shall be completely liquid immersed. The tap-changing mechanism shall have a maximum continuous current rating of 2,000 amps.
- c. An electrical feedback circuit shall be incorporated with the tap-changer motor circuit and control to ensure accurate tracking of tap position and number of operations.
- d. Regulator control system shall have Class 1 accuracy for all ratings of load voltage regulation using load side voltage transformers and shall be located internally to the regulator tank. Control calculations, using tap position, are not acceptable for regulation of the normal load-side voltage.

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- e. The regulator shall be equipped with a source-side internal differential potential transformer (IDPT) to provide a measured source-bushing voltage and differential voltage (load bushing to source bushing). This shall provide a control accuracy of $\pm 1\%$ (ANSI® Class 1) for reverse power regulation.
- f. The regulator main coil, reactor, and potential transformer shall include thermally upgraded insulation to permit operation up to 65 °C rise without loss of life to the insulating system. At 65 °C rise, the regulator shall provide 12% extra current capacity over the base current rating. A suitably patterned, epoxy-coated insulation paper shall be used in all windings. Prior to assembly of the main core and coil assembly, the windings are to be baked with sufficient mechanical pressure exerted on the sides of the coil to maximize a complete bonding of the insulation to maintain required short-circuit current withstand.
- g. Step-voltage regulators shall be designed and constructed to withstand the mechanical and thermal stresses associated with external short circuits producing maximum current values of 25 times the base rms symmetrical rated load current or a maximum of 16 kA rms symmetrical whichever is less. The first-cycle asymmetrical peak current the voltage regulator is required to withstand shall be determined as shown in Equation (2) and Table 12 of IEEE Std C57.15™-2017 standard.
- h. The regulator shall be supplied with a center-tapped reactor for the purpose of maintaining continuity while the tap-changer is changing position. The reactor shall be isolated from ground to provide protection from lightning and switching surges. Construction of the reactor shall be core type, wherein the windings occupy each of the two core limbs in order to provide balanced windings, reduce leakage current, and minimize no-load losses.
- i. Internal secondary wiring shall be color coded and labeled for easy identification.

D.5.3. External features

- a. The BIL rating of the bushings shall be compatible with the BIL of the regulator, and all bushings 15 kV and above shall have a minimum creep distance of 18 inches. The bushing designations (S, L, and SL) shall be permanently marked on the regulator cover adjacent to the bushings. The S, L, and SL bushings must be interchangeable with each other.

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- b. Material of threaded studs and connectors shall be tin-plated bronze. For regulators rated 1200 A and below, each bushing shall include a threaded 1.125" - 12 UNF-2A stud. For regulators rated 1201 to 2000 A, each bushing shall include a 1.5" - 12UNF-2A stud. For regulators rated above 2000 A, each bushing shall include a 2.0" - 12UNF-2A stud. Connectors integral to the bushing are not acceptable. Refer to Table 2 for standard terminals that will be provided.

Table 2 - Bushing Connectors

<u>Current Rating</u>	<u>Terminals</u>
150 A and below	Clamp-type terminals for #6 to 250 MCM Conductor
151 A to 668 A	Clamp-type terminals for #6 to 800 MCM Conductor
669 A to 1200 A	4-hole spade 0.375 in. minimum thickness
1201 A to 2000 A	4-hole spade 0.5 in. minimum thickness

- c. All regulators shall be provided with an external UltraSIL, Evolution URT (MOV) type bypass arrester connected across the series winding. For units rated less than 22 kV, the series arrester shall be rated 3 kV. For units rated 22 kV or larger, the series arrester shall be rated 6 kV.
- d. A fluid sight gauge shall be provided that indicates fluid color and critical level at -20 °C.
- e. An external, corrosion-resistant position indicator shall indicate the tap-changer position. The position indicator shall be polymer constructed, mounted above the oil level, and slanted downward at a 45-degree angle for ease of reading when the regulator is mounted above ground level.
- f. An ADD-AMP feature which will permit additional current-carrying capabilities at reduced regulation, as shown in Table 3, up to 2000 amps shall be available. The ADD-AMP type adjustment shall be located inside the position-indicator faceplate to prevent inadvertent adjustment. In addition, a SOFT ADD-AMP feature shall be available which can be enabled through the control keypad or SCADA.

Table 3 - ADD-AMP Adjustments

<u>Regulation (%)</u>	<u>Current (%)</u>
±10.0	100
±8.75	110

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±7.5	120
±6.25	135
±5.0	160

- g. Stainless steel mounting bosses shall be provided for the addition of lightning arresters adjacent to the source (S), load (L), and source-load (SL) bushings. The bosses shall be fully welded around their circumference. Spot welding is not acceptable.
- h. All regulators shall have a 1" drain valve with sampling device and a 1" upper filter press connection.
- i. A hand-hole shall be provided on the cover of the regulator for inspection purposes and to access terminals used to reconnect the regulators for operation at large variations of system voltage.
- j. Regulators with substation base mounts shall have two stainless steel ground pads located diagonally opposite from each other. Each NEMA 2-hole pad shall have two stainless steel 1/2"-13 UNC ground provisions. All grounding provisions are to be located near the base of the regulator.
- k. Each regulator shall be provided with two laser-etched nameplates, one mounted on the control enclosure and the other mounted on the regulator tank. The nameplates shall have the manufacturer code and serial number bar-coded with "3 of 9" coding with a 0.25" minimum height. Each nameplate will include at a minimum the following:

- Rated kVA
- Rated current
- Rated voltage
- Rated range of regulator
- Rated frequency

Complete diagrams showing the leads and internal connections and their markings, including polarity markings, and the voltages obtainable with the various connections at ratio correction transformer taps and corresponding system voltages, total weight, untanking weight, weight of oil. The nameplate

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shall indicate that the PCB content is less than 1PPM, Number of gallons of mineral oil it contains, unit short circuit rating, tap changer motor capacitor size.

- l. The regulator shall be of a sealed-tank construction to permit operation at 65 °C rise without increasing the oxidation rate of the oil. A 5 PSIG, 50 SCFM pressure-relief device shall be supplied above the 110 °C fluid level.
- m. The voltage regulator shall remain effectively sealed for a top fluid temperature range of –20 °C to +110 °C for continuous operation at rated kVA and under operating conditions as described in loading guide IEEE Std.C57.91™-2011 standard, without gaskets and O-rings seizing or deteriorating, for the life of the voltage regulator.
- n. The external parts of the tank and control enclosure shall be painted light gray, Munsell 5BG7.0/0.4, and meet the coating and security requirements of IEEE Std C57.12.31™-latest revision of standard. The inside of the tank and bottom of the cover shall be provided with a minimum of a gray coat of primer.
- o. An external electrical connection between the cover and tank shall be supplied to allow the cover suspended internal assembly and tank to be grounded together to eliminate voltage differentials during energizing.
- p. Thermometer provisions shall be provided for all substation voltage regulators.
- q. A multi-conductor neoprene 600 V, –50 °C to 105 °C cable with disconnect plugs at each end shall provide the connection between the internal circuitry of the voltage regulator and the control.
- r. An electronic device shall be provided to protect the internal CT from high voltages due to the control cable being disconnected or cut while the voltage regulator is energized.
- s. The motor starting capacitor shall be located inside the control enclosure and be easily accessible for maintenance.
- t. The control cable connecting between the control box and voltage regulator shall be of a quick connect type which allows for removal and replacement of the control enclosure while the voltage regulator is energized. Hardwired control

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cables are not acceptable.

D.5.4. Voltage regulator control

The Voltage regulator control shall be the equivalent of the Eaton / Cooper CL-7 multiphase control for two regulators. Model No. CL72E60000LB33

D.5.5. Control Physical Features

- a. The voltage regulator control shall be Microprocessor-based
- b. Modular design to allow for easy installation and removal of accessory hardware to enable the addition of features and functions.

D.5.6. Control Features

Basic voltage regulation settings: These basic voltage regulation settings shall be available:

- a. Set voltage with a range of 100.0 to 135.0 volts in increments of 0.1 volts for both forward and reverse power flow.
- b. Bandwidth with a range of 1.0 to 6.0 volts in increments of 0.1 volts for both forward and reverse power flow.
- c. Time delay with a range of 5 to 180 seconds in 1 second increments for both forward and reverse power flow.
- d. Line Drop Compensation settings for resistance and reactance with a range of adjustable of -96.0 to +96.0 volts in increments of 0.1 V both for forward and reverse power flow.
- e. System configuration with preconfigured options of Wye (Star), Delta Lead and Delta Lag settings. A separate setting of phase angle for Delta connections is not acceptable.
- f. Four control operating modes:

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Sequential – Calls for voltage regulation when the compensated voltage falls outside the voltage band for the time delay period. The time delay counter resets each time the compensated voltage crosses into the voltage band.

Voltage Averaging – Determines the compensate voltage average and calls for voltage correction when the average falls outside the band for the time delay period.

Time Integrating – Calls for voltage regulation when the compensated voltage falls outside the voltage band for the time delay period. Decrements the time delay counter by 1.1 seconds for each second in band when the compensated voltage crosses into the band.

Dynamic Bandwidth – Dynamically adjusts the bandwidth when excessive tap changer operations occur because of distributed generation. This mode treats the time delay the same as the sequential mode.

- g. Reverse power operation: The control reverse power capabilities shall have these features:

Allow automatic operation of the voltage regulator under reverse power flow conditions.

Establish a current sense threshold with a minimum setting of 1% of the current transformer primary rating. The current sense threshold will be the level at which the control is able to accurately determine the power flow direction.

Determine reverse power using these strategies:

Compare voltage and current phase angles when real current is above the current sense threshold.

Use a test tap strategy biased in the prior direction of power flow to determine the direction of the stiff bus and the proper direction of voltage regulation when current falls below the current sense threshold or when required by the distribution system conditions.

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These reverse sensing modes shall be available:

- Locked Forward
- Locked Reverse
- Reverse Idle
- Bidirectional
- Neutral Idle
- Cogeneration
- Reactive Bidirectional
- Bias Bidirectional
- Reverse Cogeneration
- Bias Cogeneration

- h. Voltage limiter: A voltage-limiting capability providing this functionality:

Provide first-house protection by preventing the load voltage from exceeding a set limit when using the line-drop compensation feature.

Provide fast when the load voltage exceeds the voltage limiter limits. In conjunction with this functionality, voltage limiter and fast response voltage limiter time delays will be available to set the delay for operation of the feature. The delays settings will range from 1 to 60 seconds.

- i. Voltage Reduction: A configurable voltage reduction functionality to reduce voltage from 0.1% to 10%. The voltage reduction feature must consist of these modes of operation:

Local/Digital Remote to activate a single voltage reduction level either locally at the control or remotely by writing an analog value to a digital SCADA data point.

Remote Latch to activate up to three voltage reduction levels by latching one, two or both analog digital SCADA points.

Remote Pulse to activate up to 10 voltage reduction levels by pulsing an analog or digital SCADA point. The number of pulse steps and percentage per steps must be user configurable. A terminate SCADA point must also be available to turn off voltage reduction for this mode.

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SCADA Pulse to activate up to three voltage reduction levels by pulsing three distinct digital SCADA points. A terminate SCADA point must also be available to turn off voltage reduction for this mode.

SCADA Latch to activate up to three voltage reduction levels by latching three distinct digital SCADA points.

D.5.7. Communications

- a. Control Data Ports: The control shall include these communications data ports.

USB data-drive port with programming and data retrieval capabilities shall be available. A user must be able to upload or download control parameters and data without requiring the use of a computer or external hand-held device.

A front-panel data port shall be available for temporary direct communications to a computer with designated interface software using a readily and commercially available cable. The communications link must allow for control programming and uploading/downloading of data.

- b. SCADA: The control digital SCADA interface shall have these features.

Equipped with the following communications interface

Ethernet 100BASE-FX Multi-Mode (Fiber-Optic) ST

The following resident communications protocols, user-configurable and available for both communications ports shall be available:

DNP3 (Serial and Ethernet)

IEC 60870-5

2179

MODBUS Serial

MODBUS TCP/IP

- c. When voltage regulation is being controlled remotely via SCADA communications, a method of returning the control to local operation using standard control settings must be available. At a minimum, the following

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settings should be restored when communications is lost: Forward and reverse settings for set voltage, bandwidth, time delay, and line-drop compensation; Auto-Block feature state; Reverse Power mode; Voltage Reduction; Tap- to- Neutral, control operating mode, voltage reduction, and SOFT ADD-AMP. This auto restore functionality must have two means to trigger the return to local settings as follows:

Heartbeat – The control returns to local control when an incremented integer is not received within the auto restore to local time period.

Coms – The control returns to local control when a communications signal is not received within the auto restore to local time period.

D.5.8. ACCESSORIES

- a. Remote mounting cable to allow remote placement of the regulator control. The cable shall be 30 feet in length and shall be pre-connected at the factory.
- b. Thermostatically controlled control enclosure heater.
- c. Stainless Steel control box.

D.6. SUBSTATION TRANSFORMERS (Group I)

These transformers shall designed and constructed in accordance with the latest revision of the following ANSI Standards C57.12.00, C57.12.10, C57.12.22, C57.12.70, C57.12.80, C57.12.90, C57.12.92

D.6.1. APPLICABLE STANDARDS

Shall be in accordance with the latest revisions of the following IEEE, Department of Energy and NEMA standards.

- a. IEEE Std C57.12.00-2010 – IEEE Standard for Standard General Requirements for Liquid-Immersed Distribution, Power, and Regulating Transformers
- b. IEEE Std C57.12.28-2014 – Sections 5.3, 5.4, 5.5 – Coating System Requirements

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- c. IEEE Std C57.12.36- 2007 – IEEE Standard Requirements for Liquid-Immersed Distribution Substation Transformers
- d. IEEE Std C57.12.70-2011 – IEEE Standard for Terminal Markings and Connections for Distribution and Power Transformers
- e. IEEE Std C57.12.90-2010 – IEEE Standard Test Code for Liquid-Immersed Distribution, Power, and Regulating Transformers and IEEE Guide for Short-Circuit Testing of Distribution and Power Transformers
- f. NEMA® TR 1-1993 (R2000) – Transformers, Regulators and Reactors, Table 0-2 Audible Sound Levels
- g. 10 CFR Part 431 – Department of Energy–Energy Conservation Program: Energy Conservation Standards for Distribution Transformers; Final Rule

D.6.2. SUBSTATION TRANSFORMER GENERAL REQUIREMENTS

- a. 12000 Volt delta connected primary winding.
- b. 12000 Volt delta connected primary winding furnished with full capacity high voltage taps with 4 - 2.5% taps below full rated voltage, with pad-lockable external operating handle. The external de-energized pad-lockable tap changer operating handle shall be clearly marked per ANSI C57.12.20
- c. 12 kV Δ windings shall have a BIL of 90 kV.
- d. 15 kV, 12.7 kV MCOV station class arresters shall be supplied on 12 kV windings.
- e. 2400/4160Y/2400 Volt winding shall have a BIL of 60 kV.
- f. Phase displacement for 12 kV Δ – 2.4 kV Δ connection shall be 180°.
- g. 6 kV, 4.5 kV MCOV station class arresters shall be supplied on 2400/4160Y/2400 Volt windings.
- h. Cooling - two stage rated OA/FA, utilizing 240 Volt, single phase cooling fans. Fan control incorporating temperature controlled automatic operation and

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manual operation.

- i. Magnetic liquid level indicator with alarm contact.
- j. Dial-type liquid temperature indicator with contacts.
- k. Winding temperature, dial hot spot indicator with three sets of contacts for fans, alarm and trip.
- l. Nitrogen blanket with bleeder, purge valves and pressure-vacuum gage.
- m. Upper filter press connection and valve and lower combination drain/sampling valve.
- n. A cover mounted pressure relief device, which recloses at a safe positive pressure after operation. Alarm contacts and a reset able indication of past operation of the pressure relief device are required.
- o. A manual reset type sudden gas pressure relay, device 63, with contacts suitable for operation at 130 volts, DC.
- p. Tank undercoating
- q. Reusable gaskets on hand holes and devices.
- r. Bolted hand hole.
- s. Lifting lugs
- t. Control box with anti-condensation heater
- u. Color: ANSI N0. 70, Light Gray

D.6.3. SUBSTATION TRANSFORMER BUSINGS

Transformers shall be equipped with cover mounted bushings.

Cover Mounted Bushings

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Bushings shall be porcelain, copper conductor NEMA stud. High voltage bushings shall be cover mounted in NEMA segment 1, low voltage bushings shall be cover mounted in NEMA segment 2.

Terminals

Stud to NEMA four hole flat pad terminals shall be supplied.

D.6.4. SUBSTATION TRANSFORMER CURRENT TRANSFORMERS

A single set of multi-ratio current transformers shall be supplied on primary and secondary, phase and neutral bushings. Current transformers shall be wired to short circuiting type terminal blocks in control box

Ratings as follows:

<u>Capacity</u>	<u>Secondary Voltage</u>	<u>Primary CT</u>	<u>Secondary CT</u>
5000/6250 kVA	2400/4160Y/2400 V.	400/5 A	2,000/5 A.

D.6.5. DRAWINGS

Approval drawings shall be supplied. CAD based Record drawings shall be supplied>

D.6.6. SUBSTATION TRANSFORMER INSTRUCTION BOOKS

Instruction Manual shall contain:

- a) Detailed operating instructions
- b) Outline drawings
- c) Wiring diagrams
- d) Nameplate drawing
- e) Information on component parts

END OF SECTION D >